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Introduction and Summary

When the FCC adopted price cap regulation for local exchange carriers (LECs) in its October, 1990 *Order* in CC Docket 87-313, it expressly provided for a comprehensive review and evaluation of the performance of this new regulatory regime at the conclusion of its initial three years of operation. In its *Notice of Proposed Rulemaking* (NPRM) issued February 16, 1994 in the present proceeding, the Commission sought comments on a broad range of issues relating both to the experience under the first three years of LEC price cap regulation as well as possible adjustments both to the objectives and to the mechanics of price cap regulation for the future.

The Ad Hoc Telecommunications Users Committee (Ad Hoc Committee) commissioned Economics and Technology, Inc. (ETI) to prepare this report on LEC price cap performance as part of the Committee's response to the NPRM. In this report, we address the specific issues raised in the *Notice*.¹ ETI has been a participant in a number of price cap and incentive regulation matters before state regulatory bodies,² and in preparing this report we have drawn in part on knowledge and experience obtained in those proceedings. In particular, we have had the opportunity to examine LEC productivity in considerable detail, and to quantify both historic productivity growth and LEC input price movements in several key state cases.³ We believe that this information is highly relevant and informative to the present performance review in that it provides specific quantitative results that have not otherwise been adduced in the interstate jurisdiction.

1. This report contains responses to General Issues 1 and 2, to Baseline Issues 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12, and to Transition Issues 1, 2, 3, 4, and 5.

2. These have included proceedings in California, Connecticut, Delaware, Illinois, Indiana, Maryland, New Jersey, New Mexico, New York, Ohio, Pennsylvania, Rhode Island, Tennessee, Texas, Vermont, and Washington.

3. ETI has examined LEC productivity growth and input price movements in California, Delaware, Pennsylvania, Illinois, and Ohio.

The Commission should not allow the Price Cap Plan to be manipulated into becoming a tool of industrial policy.

The essential goal of the LEC price cap plan — as it is of any system of economic regulation — is to achieve as closely as possible the “competitive result,” i.e., the price and earnings levels and efficient resource allocations that would be expected to occur in fully competitive markets, in those interstate access markets where the LECs continue to wield substantial market power. *It is not and should not be a purpose or goal of price cap regulation to promote specific LEC investment, technology, or market development goals, i.e., to become a tool of an industrial policy designed to generate potentially large amounts of cash flow to support the LECs’ particular vision of their role in the national information infrastructure of the future.* Economic regulation (price cap or otherwise) is required for LEC interstate services because these companies’ pricing policies and capital deployment strategies are not sufficiently disciplined by marketplace forces to produce efficient, desirable market outcomes. The *promise* of price cap regulation is to provide LECs with incentives to improve their overall efficiency while at the same time making LECs more accountable for the financial consequences of their managerial decisions by limiting the potential exposure of ratepayers with respect to risky LEC initiatives. The *reality* is that the price cap mechanism falls far short of providing the level of discipline that is customarily imposed by the capital-rationing process that occurs in the private, unregulated sectors of the economy, and of shielding ratepayers from effectively underwriting large-scale LEC investment programs which, through this process, are able to bypass any need to demonstrate marketplace acceptance.

If the price cap regime is modified so as to accommodate the ambitious network enhancement programs that the RBHCs and other LECs have recently announced (for example, by retaining an inappropriate low productivity offset and the consequentially excessive annual price level increases that would result therefrom), *the FCC would in effect be supporting an industrial policy that presupposes the economic merit of such initiatives over other potential technological or market alternatives.* Such pursuits would effectively vitiate the FCC’s tradition of encouraging competition and innovation in telecommunications, and would impose substantial and unnecessary risks upon the national economy by taking the country down the road of centralized, monopolistic development of the national information infrastructure while foreclosing many otherwise viable competitive initiatives.

Efficiency gains enjoyed by firms in competitive industries are not permanent; the rewards for increased efficiency present in the LEC price cap plan should similarly apply only for a limited period of time.

In competitive industries, price levels are set by the marketplace and are heavily influenced by the level of input prices confronted by individual firms, the technology and

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production methods available to each incumbent, and demand and supply conditions overall. Individual firms have incentives to reduce their costs and improve their efficiency overall, because by so doing they can generate greater profits either by (a) increasing unit profit at prevailing market (output) price levels, and/or (b) by setting prices below those charged by competitors and thereby expanding sales and market share. *These gains are by no means permanent.* In time, new production techniques and even new technologies and inventions are mimicked by rivals, and so the competitive and profit gains will frequently be short-lived. Even where protected by a patent, firms may often find it necessary to broadly license new technology in order to establish it in the marketplace. Accordingly, there is no expectation in a competitive market that an efficiency gain on the part of an individual firm will create a *permanent* increase in profits.

In competitive industries the price adjustment mechanism is subject to *constant review* by the marketplace itself; price levels are affected by a variety of processes that work to limit the actions of individual producers and the duration of gains that may result from actions that an individual firm may be able to initiate. While LECs are likely to complain that periodic “reviews” of price cap regulation, such as the instant proceeding, amount to reinstatement of RORR in disguise, such a position overlooks the inherently transitory nature of gains achievable in competitive markets.

The benefits of efficiency gains that are flowed through in the price cap plan must not be permanently institutionalized, but rather should be treated as *temporary* and factored out over time to truly mimic the competitive marketplace. The fluid nature of markets and industries must be recognized in any price cap mechanism, and it is essential in this review that the Commission consider and adopt revisions to the present price cap regime that will:

- Accommodate periodic changes in industry productivity to reflect the revolutionary changes that are taking place in telecommunications technology and demand growth;
- Accurately reflect actual changes in the price levels confronted by LECs for the *inputs* (capital, labor, materials) they purchase, rather than retain the present economy-wide inflation index, which measures changes in *output* prices for all goods and services in the economy as a whole;
- Simulate the diffusion of efficiency gains on an ongoing basis through retention — and perhaps even expansion — of the sharing requirement;
- Reflect fundamental changes in prevailing costs of money so as to confront LECs with the same types of capital market conditions that would exist for firms in competitive industries; and
- Maintain effective safeguards to prevent “gaming” of the price cap mechanism itself

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through self-serving depreciation increases and strategic investment programs whose costs are charged against "shareable earnings" but whose benefits flow primarily to the LECs' owners.

The present "X Factor" of 3.3% is far too low and should be increased.

The present "X factor" understates the true level of productivity improvements available to the LECs today. If the "X factor" is not increased to the appropriate level, the productivity gains achieved under the price cap system will not be flowed through to ratepayers, resulting in excessive and windfall LEC earnings. In short, US businesses and residents would be adversely and inappropriately impacted with higher telecommunications costs. For the "X factor" to be properly set, it must reflect all of the following conditions:

- The growth rate of LEC input prices (a component in the development of the "X factor") is significantly less than growth in the rate of national inflation;
- The growth rate of actual LEC total factor productivity in the post divestiture time frame is greater than both current economy-wide productivity as well as long-term (pre- and post-divestiture) LEC productivity; and
- A consumer productivity dividend to assure that the efficiency gains attributable specifically to price cap regulation are flowed through to ratepayers.

The scope and nature of exogenous cost adjustments should be further limited.

The Commission's tentative decision to narrow the scope of cost changes that would be considered for "exogenous treatment" under the Price Cap rules is fundamentally correct and should be adopted. In order for the price cap mechanism emulate the functioning of a competitive market, the exogenous cost standard should be tightened to exclude all but those economic cost changes that are directly attributable to well-defined regulatory actions specifically and uniquely affecting local exchange carriers.

In considering any proposed exogenous or "Z-factor" adjustment, the key question before the Commission should not be the magnitude of the direct impact on the LEC of the cost change *per se*, but rather how a cost change of that same type is likely to be responded to by nonregulated firms operating in competitive industries. In competitive markets, individual firms have little opportunity to pass through, dollar-for-dollar, the impact of "unforeseen" cost changes that may be "beyond management's control" to their customers. If the "unforeseen change" has a broad economic impact (such as, for example, an increase in federal payroll tax rates or mandated accounting changes such as SFAS 106 with respect to post-retirement

benefits other than pensions), its effects should be captured in the general inflation index GDP-PI which would, in turn, flow through to the price cap index. If, on the other hand, the "unforeseen cost change" is localized geographically (e.g., a change in state tax rates, local building codes, or even a natural disaster), an individual firm operating in competitive markets would have limited ability to raise prices where its competitors were not themselves similarly impacted. Either way, no automatic flow-through would occur, and none should be permitted under the Commission's price cap rules.

LECs have in the past argued that even if a cost change is captured to some degree in the general inflation index, they should nevertheless be entitled to a Z-adjustment to the extent that the impact of the event *upon LECs* is *disproportionate* to the overall inflation index. The problem, of course, with permitting "disproportionate" effects to be treated as Z-adjustments is that by their very nature individual changes in cost (relative to overall inflation) are disproportionate *in both directions*. If LECs are permitted to claim exogenous cost treatment where a specific cost change exceeds GDP-PI, then they (or someone) must assume responsibility for capturing and calculating all situations in which the effect of the cost change is disproportionately *less* than the change in GDP-PI. As the Commission has recognized, LECs cannot be relied upon to undertake this responsibility, and the Commission would require a substantial commitment of resources to initiate a continuing program to undertake this effort on its own. Accordingly, the only type of cost change that should be considered for Z-adjustment treatment is one which results from regulatory actions that uniquely and specifically affect local exchange carriers. An overly-broad definition of allowable exogenous costs exacerbates the intrinsic bias in the process of identifying and adjusting for exogenous cost changes, and thus favors the LECs and works to the disadvantage of ratepayers.

The access services market is not competitive today; there is no need for additional pricing flexibility in the LEC price cap plan at this time.

The LEC price cap plan, as it exists today, offers substantial flexibility that has yet to be fully utilized by the LECs. *It is therefore neither necessary nor appropriate to increase the level of flexibility at this time; to do so could well frustrate the Commission's ongoing efforts to foster competition in access services.* The existing basket and band structure, combined with the other price cap features, offers sufficient pricing flexibility to allow the local carriers to adapt their pricing to the nascent competition that they face. The nature and dynamics of the access market are such that the limited filing and cost support requirements that exist under price caps today do not affect the ability of the LECs to "compete" with rivals that collectively control *less than a one percent share* of the total access market. The only category of service that is even theoretically competitive is interexchange services, which (in the *interstate* context) are limited to the handful of cases where a LATA crosses a state line or the two "corridors" in the northeast. And with respect to intraLATA interstate services, IXC competition is virtually non-existent due to the preemptive 1+ routing advantage that is still

enjoyed exclusively by LECs.

While it may be appropriate to permit more streamlined and flexible regulation of LEC services when, as and if market changes justify such revisions, there is no question but that such revisions are not justified at this time. When necessary, pricing flexibility can be granted through methods other than basket revisions. The zone density pricing plan approved as part of CC Docket 91-141 is an example of one such alternative — other plans can also be devised where necessary and appropriate. The existing rules also allow LECs to propose “below band” prices. Significantly, the vast majority of the local carriers have yet to avail themselves of the full level of pricing flexibility now possible under the Commission’s rules. There has been no demonstration that the present degree of flexibility is not adequate for all reasonable competitive LEC responses, or that other less extreme measures than revision of the basket structure might not achieve whatever “flexibility” requirements may be needed over the next several years.

Other ongoing proceedings should not be affected by this review

In evaluating potential modifications to the existing price cap system, the Commission must be very careful not to produce unwarranted impacts upon the goals it is presently pursuing in other proceedings. If, for example, additional pricing flexibility were to be granted as a result of this review, that added flexibility may be used by LECs to frustrate Commission policies regarding, for example, expanded interconnection and open network architecture. As we noted in our recent paper, “Access and Competition: The Vital Link”⁴ all elements of the access environment (Part 36, Part 69, Universal Service funding, and the price caps form of regulation) are intricately interrelated. Correction of the various defects in the existing price cap system will support the Commission’s objectives in assuring an efficient and, where possible, a competitive access environment. At the same time, however, the Commission should not permit the present proceeding to be used by the LECs as a “back-door” means of accomplishing parochial goals that the Commission has otherwise not accepted.

4. See, *Access and Competition: The Vital Link*, March 1994, prepared for the Ad Hoc Telecommunications Users Committee by Economics and Technology, Inc., included as Exhibit 1 to the April 15, 1994 *Petition for Rulemaking of the Ad Hoc Telecommunications Users Committee*.

General Issue 1: Goals of the LEC Price Cap Plan

General Issue 1: Should the Commission revise the goals of the LEC price cap plan so that the plan may better achieve the purposes of the Communications Act and the public interest, and if so what should be the revised goals?

The bedrock "competitive result" objective of economic regulation is not — and should not be — modified or diminished under price cap or other forms of incentive regulation, and proposals for revision of the basic FCC price cap system should in all cases be evaluated with respect to their consistency with the fundamental "competitive result" goal.

The central goal of economic regulation is to achieve a "competitive result" in industries and markets in which some degree of "market failure" precludes this outcome from occurring on its own. Market failure can occur for a variety of reasons; with respect to local exchange telecommunications services, these reasons include, *inter alia*, extreme economies of scale and scope (particularly where network ubiquity is involved), substantial positive externalities arising from the ubiquitous connectivity inherent in LEC distribution networks, high fixed costs and low (sometimes near zero) variable costs, extensive use of joint and common plant and other resources in the provision of a multitude of different services, geographic extensiveness of network coverage, a variety of *legal* privileges and protections⁵ whose individual and cumulative effect is to impose formidable barriers to competitive entry and growth, and nearly a century of protected monopoly with virtually all capital investment costs and risks having been borne by *customers*, rather than by shareholders, of the local exchange carrier (LEC) monopolies. Although the FCC and many state regulatory authorities have actively and aggressively pursued policies aimed at facilitating and encouraging the development of competition across a broad spectrum of telecommunications industry segments,⁶ such initiatives cannot and do not instantly erase these conditions or the barriers to entry which their existence has engendered, and indeed for some segments of the market may never eliminate the presence of the LEC monopoly or extreme LEC dominance.

5. These included exclusive franchises, protections against earnings erosion and competitive incursions, and in most states an "eminent domain" right to condemn rights-of-way that is rarely if ever extended to any LEC competitor.

6. See, for example, Expanded Interconnection with Local Telephone Company Facilities, Report and Order and Notice of Proposed Rulemaking, 7 FCC Rcd 7369 (1992); Expanded Interconnection with Local Telephone Company Facilities, Second Further Notice of Proposed Rulemaking, 7 FCC Rcd 7740 (1992); Expanded Interconnection with Local Telephone Company Facilities, Second Report and Order and Third Notice of Proposed Rulemaking, FCC 93-379, released September 2, 1993, in CC Docket No. 91-141.

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In the case of telecommunications and many other “public utility” type services, the regulatory “solution” to the market failure condition was to impose a form of *financial* regulation in which the monopolies’ earnings, defined in terms of “return on investor-supplied capital,” would be constrained to that level which would prevail were the same capital invested in “competitive” industries with comparable risk and liquidity. Under so-called “rate of return” regulation (“RORR”), rates were set so as to permit the LECs to earn a “competitive return” on net investment after dollar-for-dollar reimbursement for all operating costs including depreciation expenses. Under this type of “cost-plus” regulation, rates and costs were inextricably interlinked: It was argued that LECs had little incentive to reduce costs (since all costs were reimbursed) and indeed that LECs and other utilities subject to this form of regulation actually had an incentive to *overcapitalize* — to “gold-plate” their asset base so as to *increase* the dollar amount of earnings that would be allowed thereon.⁷

In establishing “price cap” regulation for LECs in CC Docket 87-313, the Commission sought to remove the *direct* linkage between rates from costs that underlies ROR regulation by supplementing the pure “earnings” basis of regulation with a focus on *price levels*. Under price cap regulation, RORR is used to establish the “going in” rate level and to provide a standard through which the various parameters of price cap regulation were established and by which the effectiveness of price cap regulation can be evaluated. While some have tried to portray the FCC’s action as constituting an outright *replacement* for — amounting to an abandonment of — RORR, even a cursory examination of the Commission’s price cap rules reveals a clear intention that the basic goals of RORR — the establishment of just and reasonable rates *at competitive levels* — was not altered. Indeed, the Commission merely modified the *mechanics* of rate regulation so as to increase its reliance upon competitive and management incentives and decrease (but not eliminate) its adherence to strict, inflexible *accounting* rules and reporting requirements. The Commission never intended nor expected that rate levels under price caps would differ materially from “competitive result” levels — indeed, the Commission explicitly *expected* that under price caps rate levels would be *lower* than under RORR precisely because of the greater operating efficiencies that incentive-type regulation would be expected to foster. This fundamental linkage between the new price cap regime and traditional goals and principles of RORR is revealed in several key features of the LEC price cap plan:

- “Going-in” rate levels were based upon traditional RORR parameters — rate base, rate of return, operating expenses, depreciation.
- The annual price cap rate adjustment was intended to *simulate* conditions that would prevail under “normal” RORR practices — change in LEC input price levels offset

7. Averch, Harvey and Leland L. Johnson, “Behavior of the Firm Under Regulatory Constraint,” *American Economic Review*, 52:5, 1962.

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by growth in LEC productivity.

- Projected growth in LEC productivity was based upon industry experience and trends extant under the RORR regime.
- The “consumer dividend” was introduced to reflect the anticipated *improvement* (relative to RORR) in efficiency and productivity that would arise under incentive regulation.
- The “sharing mechanism” was intended to limit LECs’ ability to increase earnings above “competitive” levels, and is enforced on the basis of traditional RORR parameters.
- The “low end” protection against earnings erosion is expressed in terms of and is based upon traditional RORR principles.⁸

The bedrock “competitive result” objective of economic regulation is not — and should not be — modified or diminished under price cap or other forms of incentive regulation, *and proposals for revision of the basic FCC price cap system should in all cases be evaluated with respect to their consistency with the fundamental “competitive result” goal.*

In competitive industries,⁹ price levels are set by the marketplace and are heavily influenced by the level of input prices confronted by individual firms, the technology and production methods available to each incumbent, and demand and supply conditions overall. Individual firms have incentives to reduce their costs and improve their efficiency overall, because by so doing they can generate greater profits either by (a) increasing unit profit at prevailing market (output) price levels, and/or (b) by setting prices below those charged by competitors and thereby expanding sales and market share. These gains are by no means permanent. In time, new production techniques and even new technologies and inventions are mimicked by rivals, and so the competitive and profit gains will frequently be short-lived. Even where protected by a patent, firms may often find it necessary to broadly license new

8. Under the low end adjustment mechanism, if the earnings of a LEC fall below 10.25% in a base year, the LEC may adjust its rates upward to target earnings to 10.25% using the prior period as the baseline. *LEC Price Cap Order*, 5 FCC Rcd at 6788.

9. A “competitive industry” is one in which no single firm can have a significant influence upon overall market price levels and in which the various producers’ products or services are sufficiently close substitutes to one another that only relatively small price differences will be sustainable. The theoretical “perfectly competitive” market is the limiting case, but markets that fall far short of this theoretical model are able to function quite competitively. The “competitive result” goal of economic regulation requires results comparable to “effective competition,” not “perfect competition.”

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technology in order to establish it in the marketplace.¹⁰ Accordingly, there is no expectation in a competitive market that an efficiency gain on the part of an individual firm will create a *permanent* increase in profits.

In short, in competitive industries the price adjustment mechanism is subject to *constant review* by the marketplace itself; price levels are affected by a variety of processes that work to limit the actions of individual producers and the duration of gains that may result from actions that an individual firm may be able to initiate. While LECs may complain that periodic “reviews” of price cap regulation, such as the instant proceeding, amount to reinstatement of RORR in disguise, this conveniently overlooks the inherently transitory nature of gains achievable in competitive markets.

The fluid nature of markets and industries must be recognized in any price cap mechanism, and it is essential in this review that the Commission consider and adopt revisions to the present price cap regime that will

- Accommodate periodic changes in industry productivity to reflect the revolutionary changes that are taking place in telecommunications technology and demand growth;
- Accurately reflect actual changes in the price levels confronted by LECs for the *inputs* (capital, labor, materials) they purchase, rather than retain the present economy-wide inflation index, which measures changes in *output* prices for all goods and services in the economy as a whole;
- Simulate the diffusion of efficiency gains on an ongoing basis through retention — and perhaps even expansion — of the sharing requirement;
- Reflect fundamental changes in prevailing costs of money so as to confront LECs with the same types of capital market conditions that would exist for firms in competitive industries; and
- Maintain effective safeguards to prevent “gaming” of the price cap mechanism itself through self-serving depreciation increases and strategic investment programs whose costs are charged against “shareable earnings” but whose benefits flow primarily to the LECs’ owners.

In the course of this investigation, the Commission will likely be asked by LECs to make

10. This is particularly the case where the underlying product or service is characterized by significant externalities in either demand or supply, as is often the case with telecommunications and information technology. Examples include personal computer hardware and software “platforms,” videocassette formats, facsimile machine communications standards and protocols, modems, and data storage and transmission media.

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revisions that are essentially *opposite* to the ones just enumerated: The Commission will be asked to freeze the productivity offset at present levels (or perhaps even to reduce it), to retain the economy-wide output price inflation index as a surrogate for LEC input price movements, to eliminate sharing altogether, to make no changes in aggregate LEC rate levels despite sustained decreases in interest rates, and to permit LECs unconstrained freedom to modify depreciation rates and undertake capital spending programs irrespective of their economic merit or confluence of cost and benefit impact. Each and all of these LEC positions undermines and frustrates the "competitive result" goal, and for that reason alone all should be summarily rejected as the transparent, self-serving revenue enhancement stratagems that they are. Adherence to the basic "competitive result" target will serve the Commission well in maintaining a dynamic and responsive incentive regulation program.

General Issue 2: Effect of Price Caps on Consumer Welfare

General Issue 2: What has been the effect of the price cap plan on consumer welfare, the economy, and the creation of jobs both in telecommunications and in other sectors of the economy. Quantify the effects of the price cap plan or of possible revisions on consumer welfare, the economy, and the creation of jobs in the future; e.g., quantify the extent to which productivity is increased, the extent to which this increased productivity leads to domestic job growth, the extent to which profit margins improve because of the lower cost of telecommunications, and the ways in which the conduct of business has changed as a result of increasing reliance on telecommunications. We ask commenters to provide data and analysis on how the current price cap plan or a revised plan would affect growth in telecommunications markets, revenues, profits by LECs and CAPs, competition in local exchange and access services, competition in interexchange services, and levels of demand for telecommunications services.

While some may attempt to attribute various events and conditions in the telecommunications industry and in the economy generally to price cap regulation, making such attributions at this time is extremely difficult.

The Commission will undoubtedly be flooded with "studies" sponsored by LECs and prepared by LEC consultants that purport to demonstrate some positive relationship between price cap regulation and "consumer welfare, the economy, and the creation of jobs in the future;" and (in response to General Issue 2) efforts to "quantify the extent to which productivity is increased, the extent to which this increased productivity leads to domestic job growth, the extent to which profit margins improve because of the lower cost of telecommunications, and the ways in which the conduct of business has changed as a result of increasing reliance on telecommunications."

There are at least four major problems with such studies. Each of these are summarized briefly in this section of this report. More detailed technical analyses of issues 1 and 2 are then presented in the two sections that follow this summary.

1. Identification of cause and effect relationships regarding the possible linkage between telecommunications investment and economic activity

First, most LECs argue that one of the fundamental goals of price caps is to promote investment in telecommunications infrastructure which will then cause a variety of beneficial

results in the US economy. However, there is a very serious problem with determining cause and effect relationships in such quantitative analyses: LECs generally argue that there is a direct — and *causal* — link between telecommunications investment and economic growth.

We conducted an empirical analysis based on 136 countries around the world to test this claim.¹¹ Our specific hypothesis is that for less developed countries, telecommunications investment does cause economic growth; however, for advanced economies such as the United States, we believe that telecommunications development does not cause economic growth.¹² This is because there is a “threshold” level of telecommunications infrastructure which is necessary for less developed economies to attain in order to increase economic activity. The United States and other advanced economies have passed this threshold level many years ago.

Our empirical results — based on sophisticated causality statistical methods — shows that our hypothesis is correct. Thus, there is no reliable evidence to support such the LEC claim for advanced economies such as the United States. It is true that for less developed countries, such as Mexico and the developing economies of Eastern Europe, such a cause and effect relationship is clearly present. This should not be surprising: A “threshold telecommunications infrastructure” is essential for an economy to grow. With only six telephones per 100 residents, economic activity in, for example, Mexico is likely to benefit from increased communications capability. However, in the US, with over eight times that level — i.e., 50 telephones per 100 residents — our results confirm the equally unsurprising result — that *there is no specific cause and effect relationship* flowing from marginal enhancements to what is unquestionably the most sophisticated telecommunications system in the world to consequential macroeconomic impact.

Indeed, even if some small absolute gains could be identified to result from investment in the telecommunications sector, in the context of an industrial policy that is aimed at directing or encouraging the flow of resources in a particular direction — the policy being affirmatively sought and sponsored by the Regional Bell Holding Companies and, apparently, the Clinton Administration — the relevant assessment must be based not upon *absolute* results, but instead upon the *relative* gains from investment in telecommunications vis-a-vis alternative uses of the same economic resources. Thus, government-sponsored initiatives intended explicitly to increase investments in telecommunications infrastructure *for the specific purpose* of improving the macroeconomy are likely to form a misguided, imprudent, and costly policy.

11. The details of our analysis are presented in the Technical Analysis of this issue later in this section of the report.

12. Although telecommunications investment and economic growth may be correlated in such advanced economies, this does not mean that increases in investment will *cause* increases in economic growth.

2. Calculation of the lost benefits of lower telecommunications prices in a complete simultaneous equations macroeconomic model

Business and consumers spend some \$90-billion dollars a year on LEC telecommunications services.¹³ The argument for maintaining the 3.3 % X factor at a deliberately understated level focuses on the assumed benefits of the investment that LECs purportedly are making (or will make) in telecommunications infrastructure and the eventual potential effects of such investment on industrial productivity. Unfortunately the LEC-sponsored models put forward to support this view ignore a critical component.¹⁴ They never analyze what would happen if the LECs were to just lower prices to business and consumers via a higher X factor — rather than to spend the excess rates on telecommunications investment.

A much more accurate way to model the total economic effect is to fairly model both components simultaneously. A deliberate government policy that artificially inflates the price of services in a given sector to achieve some defined purpose (e.g., that established excessive prices for LEC services so as to finance LEC expansion) is the *economic equivalent of an excise tax* on the service or product to which the policy is applied. Under these circumstances, the correct way to examine the total economic effect of such a “tax and invest” policy is to fairly model both components simultaneously. Accordingly, in this analysis, we examine the effect on prices to consumers and businesses as a form of excise tax that is imposed upon the purchase of telecommunications services. If the price is overstated (because of a deliberately understated X factor), it is regarded as a positive tax. The extent to which the increased infrastructure investment results in additional spending in the macroeconomy is modeled as an increase in government spending. Thus a stylized view of our model is as if a

13. FCC, *Statistics of the Operations of Communications Common Carriers, 1991/1992 Edition*, Washington, DC: US Government Printing Office, 1993. One might argue that the \$90 billion is an overestimate of the industry which will be affected by any FCC price cap ruling since that figure includes both interstate and intrastate services and the FCC only regulates the interstate portion of the industry. However, most state Commissions — in their own implementation of intrastate price cap programs — look to the FCC for guidance as to the correct magnitude of the X factor. Thus while the new FCC X factor might technically apply only to interstate services, it will have a very significance precedential effect on intrastate service X factors set by state Commissions as well.

14. See, for example, LEC-sponsored studies by DRI in New Jersey, Illinois, Pennsylvania, and Ohio: “Telecommunications and Network Modernization and the New Jersey Economy,” Lexington, Mass.: DRI/McGraw Hill, December, 1991; “Telecommunications and Network Modernization and the Illinois Economy,” Lexington, Mass.: DRI/McGraw Hill, November 1992; and “Historical Impact of Network Modernization on the Pennsylvania Economy,” in Deloitte & Touche, *Pennsylvania Telecommunications Infrastructure Study*, Volume V, March, 1993; and “Telecommunications and Network Modernization and the Ohio Economy,” Lexington, Mass.: DRI/McGraw Hill, April, 1993; For significant criticisms of the DRI approach (in addition to those presented in this section), see US Department of Commerce, National Telecommunications and Information Administration, *The NTIA Infrastructure Report: Telecommunications in the Age of Information*, Washington, DC, October, 1991, Appendix C.

government agency taxed consumers via telecommunications rates and then invested the proceeds in projects which it perceived would increase telecommunications investment.¹⁵

One way to estimate such dynamic multiplier effects that the Commission requests is to use a small macroeconomic model which is highly respected in the economics profession. The model developed by Nobel prize winning economist Lawrence Klein is widely regarded and understood, and it is sophisticated enough to model the dynamics of economic activity. Evidence from this macroeconomic model shows clearly that the policy of maintaining a deliberately understated X factor for the purpose of increasing telecommunications investment has no immediate measurable beneficial effect on the macroeconomy when the true simultaneous nature of economic relationships are taken into account. In sum, it amounts to taking money from residential and business consumers now to perhaps provide uncertain and abstract benefits in the future.

3. Comparison of the costs and benefits of telecommunications investment with alternative government sponsored investment projects in other industries

Any analysis of implicit government investment projects as may be fostered through a deliberately understated X factor requires a comparison with other potential investment projects. The argument made by the LECs is that the investment in an information superhighway infrastructure is of paramount importance to the national economy. However, equally persuasive arguments could be made in favor of a great many alternative government sponsored expenditures. Investments in education, health, safety, highways, airports, and computer technology (among many others) all would constitute valuable and useful undertakings. Traditional cost/benefit analysis by economists is then required to measure and to compare the net benefits of each of the major competing programs to determine how scarce resources should be allocated.¹⁶ While an analysis among competing government programs is clearly essential if an industry policy of some sort is to be pursued with respect to telecommunications, it is also necessary that the relative benefits of the industrial policy vs. private sector use (which may include investment) of the same resources be considered. Even within the telecommunications sector, it is certainly far from obvious or apparent that the *best use* of a specified stock of economic resources lies in earmarking them for investment by LECs as distinct from other industry participants. While our model does not specifically address this

15. Equivalently, the government agency could then make development grants to the LECs to advance such an objective.

16. See, e.g., E. J. Mishan, *Cost Benefit Analysis*, New York: Praeger, 1973; , R. Musgrave and P. Musgrave, *Public Finance in Theory and Practice*, Second Edition, New York: McGraw Hill, 1976, chapter 7; and R. Haveman and J. Margolis, eds., *Public Expenditure and Policy Analysis*, Second Edition, Chicago: Rand McNally, 1977.

question, we are also unaware of any prior LEC-sponsored econometric study that does.¹⁷

While some might argue that those investments with the greatest potential impact on economic productivity should be undertaken, it then remains to compare the effects of each of the major competing alternative projects. Thus, for example, investments in education have long been known to enhance productivity by creating a more qualified and advanced labor force.¹⁸ The same argument would be true of the other potential investments listed above.¹⁹ In order then to fairly evaluate the government-sponsored LEC program to force infrastructure investment, one would also need to estimate the effects on the national economy of an equal expenditure on improved education.²⁰ Such an analysis could easily show that the LEC-promoted infrastructure investment programs might rank much further down the priority scale in terms of net economic benefits.²¹

Thus, if the Commission seriously considers the LEC claim that the national economy requires such an investment in telecommunications via government mandated programs, the Commission will have to examine the alternative potential government-sponsored investments in education, health, safety, highways, airports, and computer technology. On the other hand, the Commission could reject the LECs' claim that special government-sponsored programs to promote infrastructure investment (such as a deliberately understated X factor) are needed. In this latter case, the X factor would be set appropriately per the discussion of the Commission's questions in Baseline issues 3a and 3c, which we present later in this report.

17. See, e.g., the LEC-sponsored DRI studies cited earlier at footnote 14.

18. See, e.g., the "human capital" theories in G. Becker, *The Economic Approach to Human Behavior*, Chicago: University of Chicago Press, 1976.

19. In fact, those areas might be more appropriate for government investment attention because they represent goods and services which are more likely to be characterized as "public goods," whereas telecommunications — especially services such as video dialtone which are more entertainment oriented — may much more appropriately be supplied by private market forces.

20. Similar analyses have been discussed extensively in the past, e.g., when large expenditures were being made on the space program at the same time as the inner cities of the US were suffering from a variety of economic problems which many believed required a substantial financial infusion through government-sponsored investments.

21. Indeed, while the purported economic impact of telecommunications investments on the economy has been studied many times, we are unaware of *any* studies that compare the relative impact of telecommunications investments versus other investments of the same magnitude.

4. Identification of the welfare losses associated with uneconomic telecommunications investments which occur as a result of a deliberately understated "X factor"

In identifying and quantifying the differential impact of price cap regulation vis-a-vis RORR, one must also consider the potential effects upon other sectors of the economy if resources are inappropriately diverted into the telecommunications sector. For example, there are serious concerns about the potentially *uneconomic* network development plans of several regional Bells that would impose the overwhelming majority of the costs of broadband and video transmission/switching/delivery capacity upon users of *conventional* voice and voice-grade data services.²² To the extent that such uneconomic investment programs are *facilitated* by price cap regulation, their potentially large adverse impact upon the economy generally could easily overshadow any minor benefits that might have arisen in these first three years.

Technical Analysis of Item 1. Identification of cause and effect relationships regarding the linkage between telecommunications investment and economic activity

LECs generally argue that there is a direct link showing that telecommunications investment *causes* economic growth.²³ This, according to the LECs, then implies that a deliberately understated X factor would produce economic benefits to compensate for the somewhat higher than normal prices for telecommunications services. Thus, the foundation claim rests on the claimed causal relationship flowing from telecommunications investment to economic growth. This causal relationship is the subject of this technical analysis.

The number of telephones per 100 residents in a country and the Gross National Product per capita are closely related.²⁴ In this analysis, we again find this result with recent data from 136 countries around the world. While this result is not surprising, by itself it teaches nothing about causality flowing from investment in the telecommunications infrastructure to future macroeconomic activity. Since mere correlation does not necessarily imply a cause and

22. See for example, *Petition of the Ad Hoc Telecommunications Users Committee to Deny Application*, W-P-C-6913-16, February 14, 1994 and *Petition of the Ad Hoc Telecommunications Users Committee to Deny Application*, W-P-C-6926, March 11, 1994;

23. The DRI causality claim is based on an incorrect analysis presented in F. Cronin, E. Parker, E. Colleran, and M. Gold, "Telecommunications Infrastructure and Economic Growth: An Analysis of Causality," *Telecommunications Policy*, 15:6, December, 1991, at 529-535.

24. See, e.g., CCITT, *Economic Studies at the National Level in the Field of Telecommunications*, Geneva: International Telecommunications Union, 1968. Other examples are Hardy, A., "The Role of the Telephone in Economic Development," *Telecommunications Policy*, 4:4, December, 1980, at 278-286 and Jipp, A., "Wealth of Nations and Telephone Density," *Telecommunications Journal*, July, 1963, at 199-201.

effect relationship, government policymakers have been left with a lack of specific policy conclusions regarding the beneficial effect of affirmatively promoting investment in telecommunications.

In this analysis, we investigate whether or not a country's investment in telecommunications actually *causes* subsequent increases in per capita GNP. This is accomplished with new econometric tests using data from the 1993 *World Development Report* and the International Telecommunication Union's *Yearbook of Common Carrier Statistics 1981-1990*.²⁵ Our results show that in less developed countries, it can be said that telecommunications investment actually does lead to increases in economic activity in later years. However, in well-developed economies, with already high telephone density, there is no specific *causal* relationship; the most that can be said for such developed countries is that the two phenomena move together. This result is intuitively supported by the idea that a certain level of telecommunications infrastructure is necessary as a platform for future economic gains; after this critical level, other factors no doubt play a more important role in economic development, and further development of a country's telecommunications resources are driven by an increase in its overall level of economic activity.

The traditional econometric approach

The economic development literature contains a series of multi-country studies which relate the level of GNP per capita and the number of telephones per 100 residents. One example is the study by CCITT (1963) reported in Saunders, Warford, and Wellenius (1983).²⁶ There, the relationship between telephone density and economic development is based on the overall economic model shown in equation (1). This represents a linear regression model where GNP per capita (GNPPC) — in US equivalent dollars — depends on the number of telephones per 100 residents (DENSITY). Initially, GNPPC is supposed to be a dependent variable and density is assumed to be one of several explanatory variables. This is because telecommunications for both residential and commercial use is required in order for an economy to grow.

$$(1) \qquad \qquad \qquad GNPPC = a + b * DENSITY$$

We use a sample of 136 countries with recent data to further investigate the model in (1). Data is taken from the 1993 *World Development Report* and the International

25. International Telecommunication Union, *Yearbook of Common Carrier Statistics, 1981-1990*, Geneva, 1992 and *World Development Report, 1993*, published for the World Bank by Oxford University Press, 1993.

26. See, e.g., Jipp (1963) and the studies cited earlier at footnote 24.

Telecommunication Union's *Yearbook of Common Carrier Statistics 1981-1990*. We used all countries that reported data both for 1991 telephone density and for 1991 annual GNP per capita.

The statistical results show a clear and convincing relationship between density and per capita GNP. Table 1 shows that an increase in telephone density is associated with a specific increase in economic development. The adjusted R Squared, the overall goodness of fit statistic, is 0.867, which is quite high for a cross section sample.

Table 1

LS // Dependent Variable is GNPPC

SMPL range: 1 - 136

Number of observations: 136

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.
C	-187.40739	307.41399	-0.6096254
DENSITY	418.26178	14.091011	29.682880
R-squared	0.867990	Mean of dependent var	5307.353
Adjusted R-squared	0.867005	S.D. of dependent var	7848.343
S.E. of regression	2862.175	Sum of squared resid	1.10E+09
Log likelihood	-1274.438	F-statistic	881.0733
Durbin-Watson stat	1.999260	Prob(F-statistic)	0.000000

However, despite the fact that the economic relationship makes sense and that the statistical results are acceptable, there is a competing economic theory that deserves attention. In this alternative view, density is the dependent variable and economic activity is the variable which helps to explain the variation in density. With this approach, economic activity provides the resources to pay for the telecommunications development through, for example, taxation as well as increased demand from businesses and residents. This alternative economic model is shown in equation (2) and the estimated coefficients are shown in Table 2.

$$(2) \quad DENSITY = c + d * GNPPC$$

Here we also see acceptable econometric results with a statistically significant effect of per

capita GNP as it affects telephone density.²⁷ In this view, then, an increase in GNP would lead to an increase in the number of telephones per 100 residents.

Table 2

LS // Dependent Variable is DENSITY

SMPL range: 1 - 136

Number of observations: 136

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.
C	2.1231486	0.6607152	3.213409
GNPPC	0.0020752	6.991 E-05	29.682880
R-squared	0.867990	Mean of dependent var	13.13713
Adjusted R-squared	0.867005	S.D. of dependent var	17.48184
S.E. of regression	6.375368	Sum of squared resid	5446.473
Log likelihood	-443.9003	F-statistic	881.0733
Durbin-Watson stat	2.069241	Prob(F-statistic)	0.000000

The difficulty with these two regression models is thus apparent: If both are statistically and economically valid, how can one advise policymakers as to which factor — density or economic activity — is the cause and which is the effect? On the one hand, using equation (1), one would conclude that a country should increase telephone density in order to increase economic activity. On the other hand, using equation (2), one would say that increases in economic activity generate natural forces that generally lead to an expanded telecommunications infrastructure. Since both views appear to be 'right,' the advice which one would give policymakers is ambiguous and inconclusive. A classic analysis observes:

The third and perhaps most significant problem with the GDP-telephone density correlations is that ... the movement of two variables through time, or their association across a set of countries, does not imply that changes in one of the variables causes changes in the other; correlation is a test for joint variations, not causation.²⁸

27. Note that the adjusted R-squared values for the two regressions are identical; this is expected in this kind of bivariate relationship.

28. Saunders, R., J. Warford and B. Wellenius, *Telecommunications and Economic Development*, Baltimore: John Hopkins University Press, 1983 (published for the World Bank) at 83.

As econometric methods have developed over the last 50 years, there was a constant attempt to deal with this fundamental problem. It is true that the more advanced simultaneous equations model approach yields some insight into these kinds of issues by dealing with the complex interrelationships of economic effects. However, even these multi-equation models were still not suitable to the fundamental determination of which variables were endogenous (and thus properly treated as a dependent variable) and which variables could be treated as truly exogenous, causal conditions.

The Granger causality test

It was this general problem that led Granger and later Sims and Geweke and a variety of other researchers to develop the idea of *causality* in the sense of predictability.²⁹ This is a distinct methodology from that expressed in the classical approach to econometrics such as in Theil (1971) and Greene (1993).³⁰ Granger hypothesizes that an economic variable can be explained by its own past history. The question of *causality* is then one of whether or not the addition of the past history of a potential explanatory variable can help to forecast the main variable of interest. In this approach, a statistically significant lag relationship is interpreted to mean that an explanatory variable has some *causal* relationship toward the dependent variable.

In our setting, GDP is described in terms of its own past history as well as the past history of telecommunications investment. Equation (3) expresses this relationship:

$$(3) \quad GDP_t = a + \sum_{s=1}^2 b_s TELINVEST_{t-s} + \sum_{s=1}^2 c_s GDP_{t-s}$$

where t and s index years. If telecommunications investment has a statistically significant effect — measured via a traditional F test — then its past is useful in forecasting future GDP and we can say that telecommunications investment *causes* GNP. In the same manner, telecommunications investment can be expressed in terms of its own past as well as in the past of

29. Granger, C. W. J., "Investigating Causal Relations By Econometric Models and Cross Spectral Methods," *Econometrica*, July 1969, 424-438; Sims, C., "Money, Income, and Causality," *American Economic Review*, 62, 1972, at 540-552; Geweke, J., "Causality, Exogeneity, and Inference" in *Advances in Econometrics*, Cambridge: Cambridge University Press, 1982; and Geweke, J., "Inference and Causality in Economic Time Series Models," in Griliches, Z. and Intriligator, M., eds., *Handbook of Economics*, Vol. 2, New York: North Holland—Elsevier, 1984.

30. Greene, W., *Econometric Analysis*, Second Edition, New York: Macmillan Publishing, 1993, and Theil, H., *Principles of Econometrics*, New York: J. Wiley & Sons, 1971.

GDP, as shown in equation (4).

$$(4) \quad TELINVEST_t = d + \sum_{s=1}^2 e_s GDP_{t-s} + \sum_{s=1}^2 f_s TELINVEST_{t-s}$$

Thus, a Granger test of whether telecommunications investment *causes* (leads to) increased macroeconomic activity is implemented by estimating the regression model in equation (3) and testing the hypothesis that the *b* coefficients are not statistically different from zero. This is accomplished with a straightforward F test of the unrestricted versus the restricted model. If we reject the hypothesis that the *b* parameters are zero, then past telecommunications investment is important in explaining current GDP and we conclude that investment *causes* economic activity.³¹ Examination of equation (4) shows that we can also test the opposite hypothesis — that economic activity causes telecommunications investment.

The statistical results

We implement the Granger tests for a selection of 14 countries which have essentially complete data on telecommunications investment and Gross Domestic Product for the years 1981 through 1990. Data are taken from the International Telecommunication Union's *Yearbook of Common Carrier Statistics 1981-1990*. The countries are shown in Table 3 along with the F test results of the test that the *b* coefficients in equation (3) are zero.

The results show a very clear and convincing pattern. Those countries with generally less than 10 telephones per 100 residents had a statistically significant *causal* relationship from telecommunications investment to Gross Domestic Product. Of the seven countries in this 'less developed' category, five of them satisfied the Granger test. This indicates that in these kinds of countries telecommunications infrastructure does really lead to, or *cause*, economic growth in later years. The bottom half of the Table shows the results for the more developed countries in the sample. None of the seven countries in this group satisfied the Granger test. Thus, those countries with a moderate to well developed telecom network will not necessarily benefit merely by committing additional capital resources to the telecommunications sector. In these latter kinds of countries, the relationship is more complex; the minimum required infrastructure seems already to be in place, and future additions may be more likely to follow increases in GDP rather than to lead them.

31. More detailed discussion and alternatives can be found in Geweke (1982, 1984) *op. cit.* footnote 29 and Sims (1972) *op. cit.* footnote 29.

**Policy conclusions
regarding telecommunications
investment causal relationships**

Our results show that in less developed countries, it can be said that telecommunications investment actually does lead to increases in economic activity in later years. However, in well-developed economies, which already exhibit high telephone density, there is no specific *causal* relationship; the most that can be said for such developed countries is that the two phenomena move together. This result is intuitively supported by the idea that a certain level of telecommunications infrastructure is necessary as a platform for future economic gains; after this critical level, other factors no doubt play a more important role in economic development.

Table 3

Country	Telephones Per 100 Residents	F Stat	Telecom Invest Causes GDP
Tanzania	0.30	10.66	YES
Kenya	0.70	0.28	NO
Sri Lanka	0.71	0.90	NO
Syria	4.03	11.84	YES
Fiji	5.89	10.02	YES
Panama	9.33	18.63	YES
South Africa	9.74	10.81	YES
Turkey	12.21	2.19	NO
Czechoslovakia	14.89	3.03	NO
Greece	38.51	1.98	NO
Singapore	38.67	7.33	NO
Iceland	49.61	8.89	NO
United States	50.88	0.23	NO
Sweden	68.08	0.31	NO

This analysis allows us to examine the LEC claim that one of the fundamental goals of price caps is to promote investment in telecommunications infrastructure which will then cause a variety of beneficial results for the US economy. In our view, there is a very serious problem with determining cause and effect relationships in such quantitative analyses. LECs generally argue that there is a direct link showing that telecommunications investment *causes* economic growth. However, our research — based on sophisticated causality statistical methods — demonstrates that there is no reliable evidence to support such a claim for advanced economies such as the United States. It is true that for less developed countries such as Mexico there is such a cause and effect relationship. This makes sense that a “threshold telecommunications infrastructure” is required in order for an economy to grow. With only six telephones per one hundred residents, economic activity in Mexico is likely to benefit from increased communications capability. However, in US, with over 8 times that level at 50 telephones per 100 residents, our results show that *there is no specific cause and effect relationship*. Thus, government-sponsored programs designed explicitly to increase investments in telecommunications infrastructure *for the purpose* of improving the macro-economy are likely to form a misguided, imprudent, and costly policy.